RUN-TO-RUN CONTROLLER FOR USE IN MICROELECTRONIC FABRICATION

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An automated run-to-run controller for controlling manufacturing processes comprises a set of processing tools, a set of metrology tools for taken metrology measurements from the processing tools, and a supervising station for managing and controlling the processing tools. The supervising station comprises an interface for receiving metrology data from the metrology tools and a number of variable parameter tables, one for each of the processing tools, collectively associated with a manufacturing process recipe. The supervising station also includes one or more internal models which relate received metrology data to one or more variables for a processing tool , and which can modify variables stored in the variable parameter table to control the process tools using feedback and/or feed-forward control algorithms. Feed-forward control algorithms may, in certain embodiments, be used to adjust process targets for closed loop feedback control. The supervising station may have a user interface by which different feedback or feed-forward model formats (single or multi-variate) may be interactively selected based upon experimental or predicted behavior of the system, and may also permit users to utilize their own models for run-to-run control.

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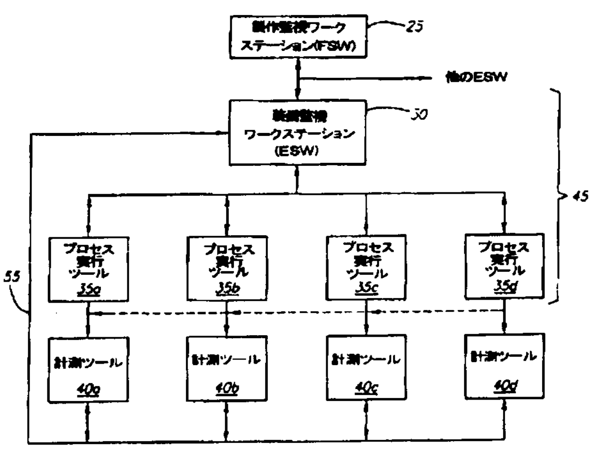
(54)【発明の名称】　マイクロエレクトロニクス製作に使用するラントゥーラン制御器

(57)【要約】
本発明は、製造プロセスを制御するプロセス自動化ラントゥーラン（run-to-run）制御器であり、プロセス実行ツール群と、該プロセス実行ツールから得られる計測測定値のための計測ツール群と、該プロセス実行を管理及び制御する監視ステーションとを含む。該監視ステーションは、該計測ツールからの計測データを受信するインタフェースと、該プロセス実行の各々に１つずつ製造プロセスのレシピ（recipe）を一括して関連付けた幾つかの変量パラメータテーブルとを含む。監視ステーションは、又、受信計測データを計測ツールのための１つ以上の変量に関係付ける１つ以上の内部モデルを含み、変量パラメータテーブルに保存された変量を修正して該プロセスツールをフィードバック及び／又はフィードフォワード制御アルゴリズムを用いて制御することができる。フィードフォワード制御アルゴリズムは、ある実施例において、クローズドループフィードバック制御のためのプロセス目標を調整するのに用いられても良い。該監視ステーションは、ユーザインタフェースを有して良く、これを用いて、異なるフィードバック又はフィードフォ



CLAIMS

[Claim(s)]
[Claim 1]it is the Laon Tourane control system which controls a manufacturing process -- with two or more processes run tools. it has two or more measurement devices which monitor operation of said processes run tool, and a surveillance station -- said surveillance station, while an interface into which measurement data is inputted from each of said measurement device, a memory, and each are saved in said memory for every each of said processes run tool, A manufacturing process, i.e., two or more variate parameter tables which bundled up to a recipe and were related with it, it has at least one model structure object which makes inputted measurement data related to one or more variates of said one or more variate parameter tables -- said variate, The Laon Tourane control system changing according to said at least one model structure object in response to said inputted measurement data.
[Claim 2]The Laon Tourane controller according to claim 1, wherein said at least one model structure object consists of feedback control models.
[Claim 3]The Laon Tourane controller according to claim 1, wherein said at least one model structure object consists of feedforward control models.
[Claim 4]The Laon Tourane controller according to claim 1, wherein said at least one model structure object consists of both feedback control models and feedforward control models.
[Claim 5]The Laon Tourane controller according to claim 4, wherein said surveillance station has further a goal setting point relevant to said feedback control model and said surveillance station adjusts said goal setting point based on an output of said feedforward control model.
[Claim 6]The Laon Tourane controller according to claim 1 choosing one or more model notations and having further a user interface which generates said at least one model structure object from this model notation.
[Claim 7]The Laon Tourane controller according to claim 6, wherein it is interactively selectable from two or more predetermined model notations in said one or more model notations and said predetermined model notation consists of a linear model notation, secondary model notations, and a 3rd model notation.
[Claim 8]The Laon Tourane controller according to claim 7 using a phasing memory least square algorithm and determining a model parameter from a test data to said at least one model structure object.
[Claim 9]The Laon Tourane controller according to claim 8, wherein a user can adjust said at least one model structure object by neutral zone nonlinear gain control.
[Claim 10]The Laon Tourane controller according to claim 8, wherein said at least one model structure object is defined by user as one of least square being adaptation, inclination being adaptation, or not being adapted.
[Claim 11]The Laon Tourane controller according to claim 8, wherein a completeness standard (integrity metrics) and a process noise of a model to said at least one model structure object are displayed by said user interface.
[Claim 12]The Laon Tourane controller according to claim 8, wherein a user can adjust said said at least one model parameter for model structures between run (run).
[Claim 13]The Laon Tourane controller according to claim 7, wherein said at least one model structure object consists of models of a multi input and a multi-output.

[Claim 14]The Laon Tourane controller according to claim 1 having further an interface into which said at least one model structure object is inputted from an external plug-in unit.
[Claim 15]All or some of each variate parameter tables download to a processes run tool compatible with before operation of said processes run tool, The Laon Tourane controller according to claim 1 downloading automatically said variate changed in response to said inputted measurement data to said processes run tool without needing a user's intervention.
[Claim 16]It is the method of controlling a manufacturing process, (a) Distance which downloads a variate from two or more variate parameter tables to two or more processes run tools, (b) Distance which operates said processes run tool according to said downloaded variate, in (c) surveillance station, Distance which monitors operation of said processes run tool and inputs measurement data from two or more measurement devices, (d) distance which applies said measurement data to at least one model structure object to which said measurement data and said variate are made related, and generates an output, (e) -- distance which updates one or more of said the variate parameter tables in response to said output -- from -- a method of becoming.
[Claim 17]A method according to claim 16 repeating said distance (a) thru/or (e), and carrying out the Laon Tourane control of said manufacturing process.
[Claim 18]A method according to claim 16, wherein said distance (d) has the distance which applies said measurement data to a feedback model.
[Claim 19]A method according to claim 16, wherein said distance (d) has the distance which applies said measurement data to a feedforward model.
[Claim 20]A method according to claim 16, wherein said distance (d) has the distance which applies said measurement data to both a feedback model and a feedforward model.
[Claim 21]A method according to claim 16, wherein said distance (c) has the distance which transmits said measurement data to said surveillance station automatically from said measurement device.
[Claim 22]A method of having further the distance which sets up a goal setting point to said at least one model structure object according to claim 16.
[Claim 23]A method according to claim 22, wherein said distance (e) has the distance which adjusts said said one or more variate parameter tables in response to comparison with said output and said goal setting point.
[Claim 24]A method according to claim 16, wherein each of said variate parameter table is correctly connected with one of said the processes run tools.
[Claim 25]A method according to claim 16, wherein each of said measurement device is correctly connected with one of said the processes run tools.
[Claim 26]A method of having further the distance which chooses interactively said at least one model structure object from two or more predetermined model notations via a user interface according to claim 16.
[Claim 27]A method according to claim 26, wherein said predetermined model notation consists of a linear model notation, secondary model notations, and a 3rd model notation.
[Claim 28]A method of having further the distance which determines said at least one model parameter for model structures from a test data using a phasing memory least square algorithm according to claim 27.
[Claim 29]A method of having further the distance which adjusts said said at least one model parameter for model structures between runs according to claim 27.
[Claim 30]A method according to claim 26, wherein said at least one model structure object is defined by user as any one least square being adaptation, inclination being adaptation, and that it is not adapted.

[Claim 31]A method of having further the distance which displays a process noise and a completeness standard of a model in said user interface according to claim 26.
[Claim 32]A method according to claim 26, wherein said at least one model structure object consists of multi inputs and multi-output models.
[Claim 33]it is the Laon Tourane controller which controls a manufacturing process -- with the 1st processes run tool. The 1st measurement device for obtaining measurement data from said 1st processes run tool, The 2nd processes run tool, the 2nd measurement device for obtaining measurement data from said 2nd processes run tool, a surveillance station, and ** and others and said

surveillance station, An interface into which said measurement data is inputted from said 1st measurement device, The 1st model structure object to which said measurement data from said 1st measurement device and a goal setting point for said 2nd processes run tools are made related, The 2nd model structure object used when controlling operation of said 2nd processes run tool by a feedback control loop, The 1st variate parameter table for said 1st processes run tools, and the 2nd variate parameter table for the 2nd processes run tools, it **** and said all or some of 1st variate parameter table is downloaded to said 1st processes run tool before operation of said 1st processes run tool -- said all or some of 2nd variate parameter table. it downloads to said 2nd processes run tool before operation of said 2nd processes run tool -- one or more variates of said 2nd variate parameter table, The Laon Tourane controller changing in response to application of said 1st model structure object to said inputted measurement data.

[Claim 34]The Laon Tourane controller according to claim 33 in order for said surveillance station to maintain operation of said 2nd processes run tool at a desired target point, wherein it adjusts a table parameter of said 2nd variate parameter table in response to measurement data from said 2nd measurement device.

[Claim 35]The Laon Tourane controller according to claim 33 having further an interface into which either said 1st model structure object or said 2nd model structure objects and both are inputted from an external plug-in unit.

[Claim 36]The Laon Tourane controller according to claim 33, wherein it has further a user interface which chooses one model notation from two or more predetermined model notations and said 1st model structure object is generated from one this chosen model notation.

[Claim 37]The Laon Tourane controller according to claim 36, wherein said two or more predetermined model notations include a linear model notation, secondary model notations, and a 3rd model notation.

[Claim 38]It is the method of controlling a manufacturing process, (a) Distance which obtains measurement data from the 1st measurement device corresponding to the 1st processes run tool, (b) Distance which applies said measurement data to the 1st model structure object that makes said measurement data related to a goal setting point for the 2nd processes run tool, (c) Distance which changes one or more variates of a variate parameter table into said 2nd processes run tool, (d) Distance which downloads said one or more variates to said 2nd processes run tool, (e) How having the distance which operates said 2nd processes run tool according to said downloaded variate.

[Claim 39]A method according to claim 38 repeating said distance (a) thru/or (e), and performing the Laon Tourane control of this manufacturing process.

[Claim 40]Distance which obtains measurement data from the 2nd measurement device corresponding to said 2nd processes run tool, Distance which applies said measurement data from said 2nd measurement device to the 2nd model structure object that makes said measurement data from said 2nd measurement device related to said goal setting point for said 2nd processes run tool, A method of having further the distance which changes one or more variates of said variate parameter table for said 2nd processes run tool according to claim 39.

[Claim 41]A method according to claim 40, wherein distance which applies said measurement data from said 2nd measurement device to said 2nd model structure object has the distance which applies said measurement data from said 2nd measurement device to a feedback model.

[Claim 42]A method according to claim 40, wherein it has further the distance which chooses one model notation from two or more model notations via a user interface and said 2nd model structure object is generated from a model notation this chosen.

[Claim 43]A method according to claim 42, wherein said two or more model notations have a line type model notation, secondary model notations, and a 3rd model notation.

[Claim 44]An interface into which it is a surveillance station which manages the Laon Tourane control of a manufacturing process, and measurement data is inputted from these two or more measurement devices, A memory which memorizes two or more output-control variates which control operation of two or more processes run tools, At least one processor which makes one or more processes of controlling said measurement device by adjusting said output-control variate based on inputted this measurement data and one or more control models perform, it **** -- a surveillance station characterized by a selectable thing from two or more control-model notations said control models were remembered to be by said memory.

[Claim 45]A control model is independently chosen for every processes run tool, and each control model, The surveillance station according to claim 44 making related some or all of measurement data that was this inputted into an output-control variate for the processes run tools concerned according to a control model selected to the processes run tool concerned.
[Claim 46]The surveillance station according to claim 45, wherein it has further two or more variate parameter tables which each was provided to each of said processes run tool, and were memorized by said memory and said variate parameter table relates to a recipe of a manufacturing process collectively.
[Claim 47]Each control model is made related [some or all of measurement data that was inputted into one or more variates of one corresponding variate parameter table for processes run tools], and them said variate, The surveillance station according to claim 46 changing according to said control model in response to inputted this measurement data.
[Claim 48]All or some of each variate parameter table. Said variate which downloaded to a processes run tool compatible with before operation of this processes run tool, and was changed in response to said inputted measurement data, The surveillance station according to claim 47 downloading automatically to said processes run tool without needing a user interface.
[Claim 49]The surveillance station according to claim 44, wherein said control-model notation contains a feedback control model.
[Claim 50]The surveillance station according to claim 49, wherein said control-model notation contains a feedforward control model.
[Claim 51]The surveillance station according to claim 44, wherein said control-model notation includes combination of a feedback control model and a feedforward control model.
[Claim 52]The surveillance station according to claim 51, wherein it has further a goal setting point relevant to said feedback control model and said surveillance station adjusts said goal setting point based on an output of said feedforward control model.
[Claim 53]The surveillance station according to claim 44 having further a user interface which chooses a control model from an available control-model notation as ** the whole processes run tool.
[Claim 54]The surveillance station according to claim 44, wherein said control-model notation includes a line type model notation, secondary model notations, and a 3rd model notation.
[Claim 55]The surveillance station according to claim 44 having further an interface into which one or more of the control-model notations are inputted from an external plug-in unit.
[Claim 56]All or some of each variate parameter table. Said variate which downloaded to a processes run tool compatible with before operation of this processes run tool, and was changed in response to said inputted measurement data, The surveillance station according to claim 44 downloading automatically to said processes run tool without needing a user interface.

[Translation done.]

CORRECTION OR AMENDMENT

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[Written Amendment]
[Filing date]Heisei 19(2007) June 20 (2007.6.20)
[Amendment 1]
[Document to be Amended]Description
[Item(s) to be Amended]Claims
[Method of Amendment]Change
[The contents of amendment]
[Claim(s)]
[Claim 1]
It is the Laon Tourane control system which controls a manufacturing process,
Two or more processes run tools,
Two or more measurement devices which monitor operation of said processes run tool,
It has a surveillance station,
Said surveillance station,
An interface into which measurement data is inputted from each of said measurement device,
A memory,
two or more variate parameter tables which bundled up to a manufacturing process, i.e., a recipe, and were related with it while each was saved in said memory for every each of said processes run tool,

It has at least one model structure object which makes inputted measurement data related to one or more variates of said one or more variate parameter tables,
The Laon Tourane control system, wherein said variate is changed according to said at least one model structure object in response to said inputted measurement data.

[Claim 2]

The Laon Tourane controller according to claim 1, wherein said at least one model structure object consists of feedback control models and/or feedforward control models.

[Claim 3]

The Laon Tourane controller according to claim 2, wherein said surveillance station has further a goal setting point relevant to said feedback control model and said surveillance station adjusts said goal setting point based on an output of said feedforward control model.

[Claim 4]

Choose one or more model notations, have further a user interface which generates said at least one model structure object from this model notation, and said one or more model notations, The Laon Tourane controller according to claim 1, wherein it is interactively selectable from two or more predetermined model notations and said predetermined model notation consists of a linear model notation, secondary model notations, and a 3rd model notation.

[Claim 5]

A phasing memory least square algorithm is used and a model parameter is determined from a test data to said at least one model structure object,
A user can adjust said at least one model structure object by neutral zone nonlinear gain control,
Said at least one model structure object is defined by user as one of least square being adaptation, inclination being adaptation, or not being adapted,
The Laon Tourane controller according to claim 4, wherein a user can adjust said said at least one model parameter for model structures between run (run).

[Claim 6]

The Laon Tourane controller according to claim 4, wherein a completeness standard (integrity metrics) and a process noise of a model to said at least one model structure object are displayed by said user interface.

[Claim 7]

The Laon Tourane controller according to claim 1, wherein said at least one model structure object consists of models of a multi input and a multi-output.

[Claim 8]

The Laon Tourane controller according to claim 1 having further an interface into which said at least one model structure object is inputted from an external plug-in unit.

[Claim 9]

All or some of each variate parameter tables download to a processes run tool compatible with before operation of said processes run tool, The Laon Tourane controller according to claim 1 downloading automatically said variate changed in response to said inputted measurement data to said processes run tool without needing a user's intervention.

[Claim 10]

Said two or more processes run tools have the 1st processes run tool and the 2nd processes run tool,
Said two or more measurement devices have the 1st measurement device for obtaining measurement data from said 1st processes run tool, and the 2nd measurement device for obtaining measurement data from said 2nd processes run tool,
The 1st model structure object to which said at least one model structure object makes related said measurement data from said 1st measurement device, and a goal setting point for said 2nd processes run tools, It has the 2nd model structure object used when controlling operation of said 2nd processes run tool by a feedback control loop,
Said two or more variable tables have the 1st variate parameter table for said 1st processes run tools, and the 2nd variate parameter table for the 2nd processes run tools,
Said all or some of 1st variate parameter table. it downloads to said 1st processes run tool before operation of said 1st processes run tool -- said all or some of 2nd variate parameter table. it downloads to said 2nd processes run tool before operation of said 2nd processes run tool -- one or more variates

of said 2nd variate parameter table, The Laon Tourane controller according to claim 1 changing in response to application of said 1st model structure object to said inputted measurement data.

[Claim 11]

The Laon Tourane controller according to claim 10 in order for said surveillance station to maintain operation of said 2nd processes run tool at a desired target point, wherein it adjusts a table parameter of said 2nd variate parameter table in response to measurement data from said 2nd measurement device.

[Claim 12]

The Laon Tourane controller according to claim 10 having further an interface into which either said 1st model structure object or said 2nd model structure objects and both are inputted from an external plug-in unit.

[Claim 13]

It has further a user interface which chooses one model notation from two or more predetermined model notations, The Laon Tourane controller according to claim 10, wherein said 1st model structure object is generated from one this selected model notation and said two or more predetermined model notations include a linear model notation, secondary model notations, and a 3rd model notation.

[Claim 14]

It is how to control a manufacturing process,

(a) Distance which downloads a variate from two or more variate parameter tables to two or more processes run tools,

(b) Distance which operates said processes run tool according to said downloaded variate,

(c) Distance which monitors operation of said processes run tool and inputs measurement data from two or more measurement devices at a surveillance station,

(d) Distance which applies said measurement data to at least one model structure object to which said measurement data and said variate are made related, and generates an output,

(e) Distance which updates one or more of said the variate parameter tables in response to said output, and a method characterized by a thing, ** and others.

[Claim 15]

A method according to claim 14 repeating said distance (a) thru/or (e), and carrying out the Laon Tourane control of said manufacturing process.

[Claim 16]

A method according to claim 14, wherein said distance (d) has the distance which applies said measurement data to a feedback model and/or a feedforward model.

[Claim 17]

A method according to claim 14, wherein said distance (c) has the distance which transmits said measurement data to said surveillance station automatically from said measurement device.

[Claim 18]

A method according to claim 14, wherein it has further the distance which sets up a goal setting point to said at least one model structure object and said distance (e) has the distance which adjusts said said one or more variate parameter tables in response to comparison with said output and said goal setting point.

[Claim 19]

A method according to claim 14, wherein each of said variate parameter table is correctly connected with one of said the processes run tools and each of said measurement device is correctly connected with one of said the processes run tools.

[Claim 20]

From two or more predetermined model notations which consist of a linear model notation, secondary model notations, and a 3rd model notation.Distance which chooses interactively said at least one model structure object defined by user as any one least square being adaptation, inclination being adaptation, and that it is not adapted via a user interface,

Distance which determines said at least one model parameter for model structures from a test data using a phasing memory least square algorithm,

Distance which adjusts said said at least one model parameter for model structures between runs,

Distance which displays a process noise and a completeness standard of a model in said user interface,

A method of having according to claim 14.
[Claim 21]
It is a surveillance station which manages the Laon Tourane control of a manufacturing process,
An interface into which measurement data is inputted from these two or more measurement devices,
A memory which memorizes two or more output-control variates which control operation of two or more processes run tools,
It has at least one processor which makes one or more processes of controlling said measurement device perform by adjusting said output-control variate based on inputted this measurement data and one or more control models,
A surveillance station characterized by a selectable thing from two or more control-model notations said control models were remembered to be by said memory.
[Claim 22]
A control model is independently chosen for every processes run tool, and each control model, The surveillance station according to claim 21 making related some or all of measurement data that was this inputted into an output-control variate for the processes run tools concerned according to a control model selected to the processes run tool concerned.
[Claim 23]
Having further two or more variate parameter tables which each was provided to each of said processes run tool, and were memorized by said memory, said variate parameter table relates to a recipe of a manufacturing process collectively,
Each control model is made related in some or all of measurement data that was inputted into one or more variates of one corresponding variate parameter table for processes run tools, and said variate is changed according to said control model in response to this inputted measurement data,
All or some of each variate parameter table. Said variate which downloaded to a processes run tool compatible with before operation of this processes run tool, and was changed in response to said inputted measurement data, The surveillance station according to claim 22 downloading automatically to said processes run tool without needing a user interface.
[Claim 24]
Said control-model notation contains a feedback control model and/or a feedforward control model,
The surveillance station according to claim 21, wherein said surveillance station has further a goal setting point relevant to said feedback control model and adjusts said goal setting point based on an output of said feedforward control model.
[Claim 25]
A user interface, wherein it chooses a control model from an available control-model notation as ** the whole processes run tool and said control-model notation includes a line type model notation, secondary model notations, and a 3rd model notation,
An interface into which one or more of the control-model notations are inputted from an external plug-in unit,
The having surveillance station according to claim 21.
[Claim 26]
All or some of each variate parameter table. Said variate which downloaded to a processes run tool compatible with before operation of this processes run tool, and was changed in response to said inputted measurement data, The surveillance station according to claim 21 downloading automatically to said processes run tool without needing a user interface.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
Especially the technical field of this invention is related with the method and device which control a microelectronics circuit manufacture process about microelectronics circuit manufacture.
[0002]
[Background of the Invention]
It depends for the quality of a microelectronics circuit which is manufactured from a semiconductor wafer, and/or parts on the consistency of the process used for the manufacture directly. Especially production of this circuit and/or parts needs etching, the deposition, the diffusion, and the cleaning process which can be reproduced. Failure when maintaining this process control within the defined manufacture tolerance brings about reduction in a yield, and reduction of profits for manufacture equipment.
[0003]
In the usual fabrication sequence, a manufacturing process gives small **** from which the characteristic of a product changes the whole batch processing. These effects originate in small change of operation of one or more process tools over the time when different batch processing is often made. In addition, in large-scale operation, in order that the same process operation may perform parallel batch processing of a product, it may perform based on two or more process tool same type. The same process prescription (a recipe is called hereafter) is usually used for carrying out parallel control of the operation of two or more same process tools. However, a not trifling change with the way each tool performs a process according to the parameter of a recipe should have dramatically different influence on the performance of the product as a result in comparison with the product processed by one of everything [the] but the same process tool.
[0004]
Conventionally, based on a regular process control (SPC) concept, the human operator has dealt with this problem manually. Especially the personal operation person monitored the manufacture output as a result of execution of the process recipe of this tool, and was adjusting the recipe to the continuing manufacture execution. However, in many cases, this process recipe can be what 100. ** -- the hand regulation to the monitor to process **** and these recipes can serve as remarkable time waste and the ease of mistaking, and lack of precise nature like.
[0005]
The usual method of monitoring a batch processing process is using x-bar/s or the x-bar/r plot in goods or the SPC software package by which internal development was carried out. Ordinarily, the distributed process data are automatically monitored using 1 set of rules (Western electric ****), and usually judge whether this process is "outside control." Manual investigation and adjustment of a process are needed whenever one data point is judged to be outside of control. These adjustments are made at a large rate and the change for every execution belonging to process unit **** is compensated. Though regrettable, if the process based on an SPC chart by which hand regulation is carried out is used, there are many problems. Probably, the usual wafer manufacture plant has an on-line SPC chart of about 2500. Supposing all the Western electronics rules are used and two new points

are exactly added to each chart per day, it will estimate, if it will be in the state of an average of 82 abnormality alarms per day. For the rapid numerousness of failures, it is reported under the situation where it starts that it is in the tendency only for the process accompanied by the most remarkable change to be maintained. However, in a certain case, the contrary was also true, many cautions were directed towards the chart and remainder had also drawn superfluous adjustment of the data point which will bring about "resonance (ringing)" of a process. Change of an additional process may enter between work shifts, and since the person of they each tries to have compensated all to mutual process adjustment, the problem was confused.
[0006]
this invention person has recognized the above-mentioned problem, and developed the advanced Laon Tourane controller suitable for use of microelectronics manufacture equipment.
[0007]
[Summary of Invention]
This invention provides the Laon Tourane controller which he followed to microelectronics manufacture for use in one field.
In one working example, the advanced Laon Tourane controller which controls a manufacturing process, The processes run (processing) tool which makes a group, 1 set of measurement devices for the Measurement Division measured value obtained from this processes run tool, and the surveillance station which manages and controls this processes run are included. This surveillance station contains the interface which receives the measurement data from this measurement device, and some variate parameter tables which related the recipe (recipe) of the manufacturing process with every one each of this processes run collectively. A surveillance station contains one or more inner models which make the received measurement data related to one or more variates for this processes run tool again, The variate saved at the variate parameter table can be corrected, and this processes run tool can be controlled using feedback and/or a feedforward control algorithm. A feedforward control algorithm may be used for adjusting the process target for closed loop feedback control in a certain working example.
[0008]
In desirable working example, this surveillance station, Have a user interface and different feedback or feedforward model notation (single or multivariate) using this, Based on the moving state over this system which is experimental or is expected, it may be chosen interactively, and acts as a user again, and to the Laon Tourane control, a user's original model may be closed, if it is use.
[0009]
being the further -- strange -- him -- change and a modification are also shown here.
[0010]
[Example]
The advanced Laon Tourane controller (ARRC:Advaced Run-to-Run Controller) system is shown. This provides recipe adjustment of formal methodology and compensates it to process **** of ****, and/or an upstream process variation. This function helps to reduce remarkably the technical time required of process maintenance and adjustment.
[0011]
One working example which carries out processes run of the platform architecture which may be used for carrying out the ARRC system of an indication is shown in drawing 1 A. In working example shown, the platform architecture usually shown with the numerals 20, It consists of the manufacture (fabrication) surveillance workstation (FSW) 25, the one or more equipment (equipment) surveillance workstations (ESW) 30, the one or more processes run tools 35, and the one or more measurement devices 40.
[0012]
FSW25 monitors and controls operation by the whole microelectronics manufacture equipment. One or more operators may monitor all the tools used through this manufacture equipment, or operation of a substantial portion. Based on the operation monitored by FSW25, an operator may control a tool group and may order it further the processes run recipe which should be used by one or more tool groups in manufacture of the product concerned.
[0013]
An equipment (equipment) tool group is usually shown by the numerals 45 of drawing 1 A. The

equipment tool group 45 contains the processes run tool 35 connected for the two-way communication of comprehensive ESW30. The processes run tool 35 consists of the usually same type. For example, all the processes run tools 35 may be furnaces (furnace). However, it is also thought that the processes run tool 35 may contain different TrueType by which grouping is carried out based on the type of the process which should be performed about the intermediate material (workpiece; a work piece is called below) on the process of manufacturing the last product.
[0014]
ESW30 receives the processes run recipe from FSW25, and it is preferably constituted so that it may be ordered the processes run tool 35 in execution of this processes run recipe. When a processes run tool consists of the same type, FSW25 may provide ESW30 with a single processes run recipe, and this recipe is used [for parallel batch-process execution] by all the processes run tools 35. As a modification, ESW30 may receive a different recipe for the one or more processes run tools 35, and the processes run tool 35 may be a tool of a type which same-types or is different in this case.
[0015]
The processes run tool 35 makes a problem the inside deviation of a tool for every run at the time of the single recipe execution not only over the deviation between tools at the time of single recipe execution but time with one or more tools. Therefore, ESW30 contains the variate parameter table (VPT) relevant to each of the processes run tool 35, as shown in drawing 5 as an example. VPT37 contains the parameter used in execution of the processes run recipe by a given processes run tool. The parameters of VPT37 often differ between tools same type depending on the original characteristic of the related tool 35 therefore. Usually, each manufacture process consists of one or more recipes (one recipe per process), and, as for each processes run tool 35, each recipe has VPT37 with the one or more processes run tools 35 for these all the processes run recipes.
[0016]
Calculation and updating are made based on the measurement data for the specific process carried out by the processes run tool with which the parameter of VPT37 is related. For this purpose, drawing 1 A receives work pieces from one or more corresponding tools, and use of the one or more Measurement Division measuring units 40 which measure the physical characteristic of this work piece by which processes run is carried out with the processes run tool 35 is shown. In working example shown, two or more Measurement Division measuring units 40a thru/or 40d are used, and each Measurement Division measuring unit is respectively related with one of the processes run tools. However, it is thought that there is no necessity with this 1 to 1 absolute correspondence. Depending on the proprietary-process execution tool used, the Measurement Division measuring unit in which the one or more processes run tools 35 are single in order to save a cost of capital and a space may be used.
[0017]
The microelectronics work piece 36 is transported to the Measurement Division measuring unit 40 corresponding from each processes run tool 35 on operation at drawing 5 so that it may be shown. This transfer shown by the line 50 may also include the automatic or manual transfer of a work piece. Each Measurement Division measuring unit 40 is constituted so that the one or more physical and/or electric characteristics of the work piece 36 by which processes run is carried out with the related processes run tool 35 may be measured. subsequently, measurement data -- the communication bus 55 -- or along with elegance, it becomes usable in ESW30 similarly. If this measurement data is provided with the Measurement Division measuring unit 40, ESW30 will update VPT37 for the tool 35 concerned which carried out processes run of the work piece 36 measured with the Measurement Division measuring unit 40.
[0018]
Drawing 1 B shows the further system architecture that may be used when at least two ESW30a and 30b are used. 1st ESW30a is preferably connected to the one or more processes run tools 35, and, on the other hand, 2nd ESW30b is preferably used for controlling the one or more Measurement Division measuring units 40. 2nd ESW30b -- the communication bus 60 -- or along with elegance, this measurement data is similarly transmitted to this 1ESW30a. The measurement data received by ESW30a ranks second, and calculates and/or adjusts the parameter of VPT37 relevant to these processes run tools 35a thru/or 35d.
[0019]

Preferably, the advanced Laon Tourane controller (ARRC) system provides the formal methodology for recipe adjustment, and compensates **** process **** (feedback control) and an upstream process variation (feed-forward control). In addition, for example, other control action modes of **** of the combination of feedback/feed-forward control, and feedback control that can be adjusted which are later illustrated and mentioned by drawing 6 may be used. The technical time when this function is required of process maintenance and adjustment in each case is reduced remarkably.
[0020]
In the case of feedback control, this ARRC system provides automatic adjustment of this recipe via all the parameters of this VPT (for example, VPT37 shown in drawing 5) based on the process result measured from the present process. This automatic regulation is attained in part by modeling the past experience, the first principle, or the process that used the measurement from a design test. With this model, determination with an intelligent controller can be made about what variate changes in this recipe through this VPT.
[0021]
In the case of feed-forward control, this ARRC system can make adjustment of [for the correction to the problem of the upper stream in a processes run sequence / be / they / any of a process target or a process variable (recipe parameter)] using the Measurement Division measured value from a former process distance. This is attained by modeling experientially which relation between two process measurement or between the process measurement from the past process, and the recipe parameter of the present process.
[0022]
Drawing 2 shows the composition of the illustration software for communication with the calculation/renewal of the parameter of measuring information and the VPT table 37 (refer to drawing 5). The ARRC system shown in drawing 2 is constituted so that the maximum advantage of the communication configurations using the standardized interface like CORBA may be acquired preferably. It counts upon exchange of the measuring information between ESW(s) of following [follow FSW25 or] plurality from this composition requiring that this Measurement Division should include a CORBA object preferably. All the measuring information ranks second, may be saved locally at ESW relevant to this processes run tool, and, in the case of feed-forward control, may be accessed by other ones of ESW(s) via communication configurations. In this case, Measurement Division was not saved at this ESW, but has avoided the single point failure.
[0023]
Here, details are explained more about the Measurement Division acquisition, preservation, and maintenance, and details are explained from that of the Laon Tourane control using this measurement data after that.
acquisition (namely, process measurement) of measurement data -- diversity -- therefore, it will be able to become difficult. For example, the specific Measurement Division measuring unit may not have an external communication function. In this case, manual input of this process result must be carried out. However, manual input is disgusted, and its fear of a data input error is high, and it is not preferred as a method which acquires measuring information in this system. ** -- when realizing a system [like], other obstacles are in acquisition of the process measurement by the opportune method. or [that the result of the last run for ESW is obtained] -- otherwise, before becoming usable, it may take several days from 1 hour. Since this process result is saved and analyzed in the way each manufacture equipment differs, it should become completely aggressive to provide the standard interface for acquiring this information, without describing in code special for each customer. The software architecture shown in drawing 2 is constituted so that the above-mentioned obstacle may be conquered or it may reduce. Explanation of each functional module is henceforth made about the portion about the Measurement Division acquisition, preservation, and maintenance.
[0024]
If drawing 2 is referred to, Measurement Division Broca 70 will be used and all the Measurement Division acquisition requests provided by the ARRC controller 75 will be managed. Each of the Measurement Division acquisition request from the ARRC controller 75 is related with the Measurement Division map which demarcates the method of acquiring this measuring result. Acquisition of measuring information will save this in the Measurement Division database 85 in order of data, time, a tool, the minimum spec.,

a lot ID, and a run number. Acquisition of a measuring result is notified to the ARRC controller 75 under request again at the time of the generating.
[0025]
The Measurement Division map is a medium which makes it possible to define the format at the time of not only the way a user acquires process measurement but their being given. The user can define the number and site (process measuring place) of a wafer, and can define a still more nearly special name to the measure point concerned.
The automated various techniques of obtaining a process measurement result may be used, and this Measurement Division map may be defined. When drawing 2 is referred to, the this automated method contains the following, for example.
[0026]
The GEM interface 90, i.e., the standardized GEM interface, is provided, and this process measurement may transfer in a highly efficient data pace, and may provide an ARRC system with this measurement. This method requires that the user in manufacture equipment should describe a custom code, and should usually take an interface for those process measurement to the surveillance workstation like ESW.
[0027]
A user is provided with the CIM composition (CORBA interface) 95, i.e., this interface, by a process measurement tool, or the APC composition of the Seman tech company and the suiting SPC data pace. In the CIM composition 95, ESW30 is reserved to a CORBA object and acquires this process measurement automatically along with measurement.
[0028]
It is provided for the ESW measurement device interface 100, i.e., the manufacture equipment user who wants this interface to carry out direct continuation of the ESW to the measurement device aiming at the Laon Tourane control.
Cooperation with the regular machine control application which provides the automation failure detection which used real-time measurement equipment is enabled as a result of SMC (i.e., this interface). An ARRC system may usually be provided with the calculation from this application as measurement from a real-time sensor.
[0029]
In addition to the automated above-mentioned Measurement Division acquisition method, the manual Measurement Division input interface 105 may be used for an ARRC system again. Here, the user interface which inputs the process measured value of this measurement device manually for the manufacture equipment with the process measurement tool which does not have external communication capability without the centralized SPC data pace is provided. Without participating in resources by the most efficient method that acquires measurement data, in order to code to GEM or a CORBA conformity interface and to establish this measurement device or an SPC data pace, and a link although there is usually nothing, Especially this function is effective for the user who wishes that the function of an ARRC system will be validated.
[0030]
Preferably, the manual Measurement Division input interface 105 enables him for a user to choose establishment of the Measurement Division request and to input new data in the UNIX (registered trademark) environment, preferably. This user window displays the information about each data, i.e., data, time, a tool, a lot number, and a recipe name preferably including the list which can scroll the established Measurement Division request. From the numerousness of the established Measurement Division requests, in order that the three fields, i.e., a tool, a recipe name, and a lot number may narrow search, it may be used. The portion of the name in which the tag was carried out by the asterisk, or the famous place may be inputted in order to carry out filtering of the useful selection. Acquisition of data is notified to the ARRC controller 75 after the input of all the measurement values about the request concerned, and this data can be processed according to this.
[0031]
Although other database structures (for example, relational data pace) may be used instead, the monotonous file for exclusive use of the Measurement Division database 85 is preferred. The Measurement Division database 85 is used for saving and managing this process measured value result.

These values are not usually saved at the standard database of ESW30 from it being often required to save measured value information at the decade thing order of the real-time process data saved in a standard ESW data pace. It should be made available when the abundance of process measured value enables strong modeling of the statistical analysis of this process, and a process preferably. ************-SU 85 is provided with separate idle-status-izing and maintenance employment of a database again.

[0032]

Each ESW30 may consist of an equipment surveillance workstation like an available type from the SEMY engineering company of Phoenix, Arizona, U.S. Integrating the function of Laon Tourane in this workstation may require the addition of some hook (hook) functions to the ESW software which is outside. Mounting is attained in relating the Laon Tourane control method 110 to the value defined as this VPT preferably. A user enables it for this relation-ized process to define the variate which can adjust this recipe to the tool according to each.

[0033]

The interaction between the processes run tool 35 and ESW is controlled by the tool server 115. The tool server 115 will carry out mutual operation to the ARRC controller 75.

ESW30 provides visual access to this VPT, and includes the parameter type (refer to drawing 7) assigned to the access level and unit per the display of a parameter, the visual minimum and the maximum, the maximum change per distance, and parameter in this access. ESW30 -- ** -- it is made like and the interface which makes it possible to a user to choose the method at the time of each variate parameter being calculated / updated increases this VPT. ** -- a user is [like] good also as defining the Laon Tourane control algorithm of custom-made specification to each parameter in a request. One of methods [an ARRC adjustment method, i.e., feedback,] only without the combination of adjustment feedback, feedback / feedforward and feedforward is assigned to each VPT parameter. About each adjustment method, it is usable in four possible adjustment modes. This adjustment mode is as follows.

[0034]

Automatic mode: This mode makes a variate parameter change automatically based on a recommendation model and a controller.

Manual verification mode: This mode asks the check of this recommendation variate parameter change to an operator.

Manual mode: This mode expects a process result without the adjustment to a variate parameter from this process model and a controller. Without affecting this process, this mode is useful, although the validity of a model is examined. This mode makes it possible to make the variate parameter recommended after an operator's checking change manually again. Before the purpose of this operational mode makes this adjustment automatically, it makes it possible to make it an operator get used with the adjustment made by this process model and the controller.

[0035]

Data acquisition mode: This mode is used for acquiring only process measured value data. This mode is required from the feedforward process when an upstream process tool being connected to ESW and not having the defined feedback controller.

Mutual operation of the ARRC controller 75 is carried out to the tool server 115, the ARRC technique 110, the Measurement Division database 85, and the Measurement Division broker 70. The rear stirrup of receipt by the Measurement Division database 85 of the process measured value result according [this] to the way of the Measurement Division broker 70 is background software processing which performs on-line processing of the ARRC technique 110 in parallel. Off-line processing helps to avoid the delay which will be attributed to acquisition of the process measured value before download of the recipe which was ARRC-calculated or was adjusted.

[0036]

The further explanation of the Laon Tourane control method is provided by reference of the block diagram of drawing 6 at any time here. As shown in front, some means are available because of acquisition of measurement data, and generation of the Measurement Division map. As an example of a method, the method of having automated which obtains process measurement includes the standardized GEM interface 90, the CIM composition (CORBA) interface 95, or the ESW measurement device

interface 100. As for an ARRC system, the manual Measurement Division input interface 105 may be used again. The information from these Measurement Division acquisition art is supplied to 1 set of Measurement Division maps 205. This is a medium which enables a user to define the format at the time of not only the acquisition method of process measured value but their being given, as annotated. Using this Measurement Division map 205, the user can define the number of wafers, and its site (process measuring place), and can define the more original name to this measure point, for example.
[0037]
So that it may not be concerned with any of feedback or feedforward (or the both) they are but may be shown in advance of run execution of a process by the control point (point) definition distance 207 in drawing 6, The control point to the various process parameters used by ARRC is set up. Setting of a control point is a role of a larger mechanism, and a user defines this process model (receiving the feedback technique especially) and the adaptation algorithm to the this chosen VPT parameter through this mechanism. This control point definition is provided so that this Laon Tourane control calculation may be enabled to combine any of this process measured value defined on the Measurement Division map with a single user, or all with the single value used for evaluating this process (gauge). For this purpose, a user chooses the Measurement Division map first for this control point definition. The same formal editor as ERUSERU of Microsoft Corp. is provided so that a user may be enabled to combine any of a value, or all with a single value. In addition to the special statistical operation like an average, standard deviation, a mean value, and the range, all the usual mathematical operations presuppose that it is desirable and usable. The user can choose each measured value from the list defined on this Measurement Division map.
[0038]
Since the model ring of a semiconductor process collects very complicated partial differential equations, it attains to the range which results in the simple relation between two variates. almost all control systems -- however, the phenomenon which poses a problem in the control using a ****** model efficiently can be described. The model in which this was complicated is because a compute instruction is made to increase and system performance is made to usually fall.
[0039]
The user will be made to make that providing that the processes run of the flexible range is possible for the diversity (namely, model notation) and the user of the ARRC technique 110 modeled and controls this process to serial the optimal as it is usable. this -- determination, now ** of the optimal model notation are also more nearly experientially [than, for example, using early "gold data set"] good. For this purpose, a user may input the procession and control variate of gold data set process measured value manually. It may be used for a least square system discernment algorithm determining this model parameter using these experiential process data. A process noise and a model completeness standard (metrics) are displayed, and a fixed quantity of quality of this model may be turned. A user is provided also with a reliability level index and the feeling of the reliability of this model is given to a user by how the good phenomenon in which this model is actual is predicted. The whole model-selection process is an interactive process in which a user will try some model structure objects by the time it discovers what expresses this process precisely.
[0040]
In one working example, model adaptation uses the correction phasing memory (fading-memory) least square algorithm incorporating a neutral zone (dead-zone) and parameter restrictions. It aims at that this correction becomes together with the capability to perform perfect or partial adjustment of this parameter further, and eases the potential problem resulting from presumed ****.The input-output data used for presumption generates this problem, when no model parameters (excitation), for example, sufficient information to determine the usual production data, are provided. The kind of Newton gradient method used in order to solve a nonlinear equation may be sufficient as a fundamental control algorithm. The Newton algorithm has the excellent convergence characteristic near the solution of a weak thing by noise. For this Reason, this algorithm enables a user to be preferably corrected by "neutral zone" nonlinear gain control, and to adjust that sensitivity to noise. There are the main advantages of this correction in enabling a quick response to big disturbance, without making distribution of a stationary state increase. A higher order controller may be used for compensating again more severe process ****. A default control parameter is automatically calculated based on this model and an input-output

data set. In order to refinement-ize this control action, a user can adjust these parameters to the maximum. Before also providing a process measurement tool simulator and performing a actual process test run, a user is assisted in visualizing operation of this feedback control, and mastering how a control parameter is adjusted and a desired moving state is realized.
[0041]
In desirable working example at the time of present, it is provided for a user for selection interactive, the following model structure object, i.e., model notation choice, at least. As this model notation choice, it is with linearity (2 parameter model, i.e., inclination, and a y intercept), a secondary form (3 parameter model), and the 3rd type (4 parameter model). These models can make with any of a single input, a single output (SISO), or a multiple input (MIMO) they are. These models are defined as a least square, inclination adaptation, or un-adapted again according to the capability (that is, it inclines, while shifting a y intercept up and down ranging over time, and a constant is maintained) to be selectively adapted, in this parameter. An adaptive model makes a model parameter change automatically based on the present measuring information received, and compensates process **** automatically. A sequential control machine is used and this process can be controlled to a regular model. External plug-in capability (see the model / the controller plug-in 221 in drawing 6) may also be provided, for example using MATLAB, and a user is enabled to define their own model, adaptation algorithm, and controller more by this. Case [like the case of the model which continued and was adapted in time], the "gold model" created from a "gold data set" may be recovered. This recovery may be automatically started by preventive-maintenance application.
[0042]
A feedback model usually provides the minimum and the maximum use restrictions which are defined not only with a desired target but with process specification. Since unusual measured value is used for this minimum and the maximum Measurement Division measured value, they protect a system. When there are one or more measurement values out of these restrictions, this system may be programmed to make or or any of whether to cancel which uses the measurement value of this each. In addition, when the range of this measurement data exceeds a predetermined maximum range value, this system may be programmed to cancel these all measuring information as invalid.
[0043]
In the same relation, an ARRC system may be programmed to mount warning and/or stop restrictions based on the number of the detected unusual measurement values. In the phenomenon by which stop restrictions were exceeded, all the future runs to the tool concerned may be intercepted, for example, or this user may be provided with warning. In the phenomenon of warning, a user may be notified of what the number of unusual measurement values exceeded, and this warning may be recorded on an audit key file. it being also possible to define it as stopping this process, or, when the variate parameter in VPT is out of the predetermined minimum stretch maximum restriction of itself, It is also possible to define it as adjusting the value of this variate parameter to the minimum or the maximum limit value simply without the relation to which is the closest to the value besides the range.
[0044]
Since Measurement Division is not acquired in a certain case, it may be defined as warning a user of acquisition of Measurement Division of warning restrictions having some bad points (a measurement device is a down, an SPC data pace obstacle, or a network problem). A stop or timeout restrictions are used and an unusual run is intercepted, or it is good that are not used by the Laon Tourane control and it also makes.
[0045]
An ARRC system like former Shimesu preferably, Provide the method for recipe adjustment and it not only compensates process **** (feedback control) of ****, and an upstream process variation (feed-forward control), but, For example, other possible control modes of operation like the feedback / feed-forward control, and the feedback control that can be adjusted which were combined are provided. As shown in drawing 6, in the case of feedback control, the feedback control algorithm 220 is mounted by the inner model / controller structure, or the model / controller plug-in 221 using the process result drawn from the control point definition 207. As shown in the continuing distance 225 in drawing 6 after application of this feedback control algorithm, preferably, it lets an ARRC system pass in all the parameters of VPT37 based on this process result, and it provides automatic adjustment of this recipe.

[0046]
The further protection to erroneous measurement is provided. This protection is subordinate to the lapsed time from the last run of the process in the tool concerned. constructing the method of protection from erroneous measurement with the process which did not perform with a specific tool in a substantial period, and was cut -- ********** -- it is especially useful. When it has passed in the predetermined period since the last run of other processes in this tool, the model used in the last run model may originate in the temporal response in a processes run tool, and may be invalid.
[0047]
When the tool server 115 (refer to drawing 2) receives the processes run recipe which should be performed by the one or more processes run tools 35 from the reference point on employment, "feedback" processes run begins. The tool server 115 tells whether it notifies the ARRC controller 75 what process measured value is expected in completion of a process run, which of the related ARRC techniques 110 is used further, and this VPT is updated after download of a recipe. When the conditions defined in advance in the ARRC technique are broken, the preparation which intercepts the continuing download may also be made. Reversing the notice of block download requires access by which secret preservation was carried out preferably.
[0048]
It is automatically notified to the ARRC controller 75 that the tool server 115 or the GEM host interface 90 having downloaded the recipe to the tool concerned and the related ARRC technique exist. the ARRC controller 75 monitors the beginning of this process and the last phenomenon, and there is no breakdown state generated between the runs concerned -- a thing check is carried out. if judged with this process run having carried out normal termination, the Measurement Division map definition (plurality) will be extracted from the ARRC technique (plurality) 110, and which process result will expect -- it should have -- it determines. if this process result is received -- the ARRC technique (plurality) 110 -- background **** -- it is calculated. In the phenomenon, to a VPT parameter, the ARRC technique 110 is changed, ranks second, the approval of a user is required, and all the change is saved at a temporary file until this recognition is received. Or this VPT change is made automatically.
[0049]
In the case of feed-forward control, the Measurement Division measured value can be used for an ARRC system from a former process distance, it can receive any of a process target or a process variable (recipe parameter) they are, can be adjusted, and correction can be added upstream of the problem in a processes run sequence. In order to carry out adjustment of this type, it is required that the relation of which [between the recipe parameters between / of two / process measured value or in the past process and the present process] between should be modeled experientially.
[0050]
ARRC feed forward techniques are dramatically similar to the ARRC feedback technique from the standpoint of mounting and composition. Generally, ARRC feed forward techniques are explained as the ARRC feedback technique in which the level was dropped. However, in ARRC feed forward techniques, since this model works as a relational operator between processes one by one, in a target process value, specification restrictions of a maximum or a minimum do not exist, either. In addition, there is no closed-loop adjustment mode and this is because it is used for the function acquiring the process measured value to the feed-forward control about a downstream process. Run restrictions and a number of a run without the Measurement Division limiting function of margins (time) cannot be found, and this is because Measurement Division is usually always required in a feedforward control system.
[0051]
In the case of feed forward techniques, the control point definition editor is strengthened by providing the special field which defines from which upper process measuring information comes. Since the model in which this control point definition editor is used to feed-forward control is completely an open loop, it does not have the capability to define, the adaptive model, i.e., the sequential control machine, for feed forward techniques.
[0052]
the time of the method of only "feedforward" being used -- the tool server 115 (refer to drawing 2) -- or alternatively the GEM host interface 90, If provided, it will notify to the ARRC controller 75, the measurement data specified from this upper measurement device will be acquired, and this feedforward

algorithm will be performed. In the phenomenon which is not usable in this Measurement Division record, the download is intercepted until it is acquired. If this Measurement Division record is pulled out, the ARRC technique (plurality) will be calculated and this VPT parameter will be updated.

[0053]

When the feedback/feed-forward control put together are used, the output from the feed-forward control technique 210 may be used so that the process target over the feedback control technique 220 may be adjusted, as shown in drawing 6.

After completing normally [any of the above-mentioned ARRC technique they are], information, i.e., VPT parameter value, the Measurement Division target, the calculated control point, and a new model parameter are recorded. All the alarms and stop phenomena which were generated by ARRC are saved at an audit key file, and are displayed on a user with tool status application. Although this alarm is set they to be [any of tool status or ARRC status application] and it may be eliminated, a stop phenomenon may be repealed only in ARRC status application (it is explained in the following paragraph like). A certain adjustment to this VPT is recorded on an audit key file again.

[0054]

It may be provided in order that an ARRC status display may view all the present status (namely, O.K., alarm, cover download) of the tool connected in the present zone concerned. This application displays the present status of a tool with the capability to view not only all the established Measurement Division requests but all the present ARRC system events. From this window, all the ARRC system interception download phenomena are cancelled, and this tool can be returned to on-line. Alarm and an interception download phenomenon can be viewed in a tool status display, and can be eliminated there. all the ARRC system events (**s, such as alarm, interception download, and adjustment) -- it is recorded on an audit key file.

[0055]

Drawing 8 is the flow chart showing signs that it looked at the Laon Tourane controlling process of drawing 6 from other viewpoints. In the Laon Tourane process 800 shown in drawing 8, both feedforward and feedback control may be used for controlling operation of a process tool (the process tool B is nominated in drawing 8). In the Laon Tourane process 800, in the first step 801, the 1st process tool (the process tool A is nominated), Processes run is performed according to the process variable downloaded towards the tool concerned from the variate parameter table (VPT) relevant to the recipe concerned. In the following step 802, the 1st measurement device (measurement device A is nominated) measures the proper output of the process tool A according to the character. In Step 803, the measured value from measurement device A follows for any of the Measurement Division acquisition method previously explained with reference to drawing 6 being, and is collected. In the following step 804, the process control point (namely, process target) over the feedforward who comes behind, and/or the Laon Tourane algorithm of feedback is set up based on the information saved on the Measurement Division map. In the following step 805, the selected feedforward control algorithm is applied by ESW30 and produces the output of a feedforward control model. These outputs adjust this process target in Step 806 for the feedback control algorithm by which it comes behind. in one field, this feedforward control algorithm provides the capability to generate the "variate" process target for the process controlled by a closed-loop feedback control loop.

[0056]

If a process target is adjusted based on the output of a feedforward control algorithm, the feedback control algorithm of Laon Tourane may be applied in Step 807. In the following step 808, it is adjusted in a variate parameter table (VPT), the process variable, i.e., the parameter, of this recipe, and the this updated variate, i.e., a parameter, is downloaded to the process tool B. In Step 809, the process tool B carries out business (plurality) assigned to self using the variate about this process recipe, i.e., a parameter. In the following step 809, the 2nd process tool (assigned with measurement device B) is used for measuring the proper output of measurement device B based on the character. In the following step 811, the measurement data from measurement device B is based on any of the Measurement Division acquisition method mentioned above they are, and is acquired. Based on the acquired this measurement data, the process control point for this feedback control algorithm is adjusted in the following step 812. This closed-loop feedback control process ranks second, it returns also to Step 807, and this feedback control algorithm is applied again here. Although this feedback control algorithm

continues and performs control of this process target (plurality) with the form of a closed loop for the process tool B, A ** process target (plurality) may be adjusted based on the output (plurality) by which the process tool A was measured, and the feedforward control algorithm shown by drawing 8.
[0057]
It is also possible to make process adjustment by the frequency where an ARRC system changes depending on this measurement data and process coordination mechanism. For a hatch tool, an ARRC system adjusts this parameter for every batch preferably. For a single wafer tool, for every lot, if an ARRC system is necessary, it may adjust this parameter for every wafer.
[0058]
It is also useful to have an usable additional software application in analyzing the track record of the past of the ARRC technique. For this reason, ESW30 is provided with ARRC analysis application. ARRC history analysis application makes it possible to view the result of the single ARRC technique, when a user chooses a tool, a zone, a recipe name, and a related variate parameter. the case of the feedback technique -- a plot -- a graph ---like -- a desired value and model prediction -- actually -- measured value and alarm, and a cover down -- a funnel -- restriction is displayed. Preferably, this plot is color-code-ized. In the case of feed forward techniques, this plot displays in graph the adjustment currently made to the following process (stage distance plot) in time. In both feedback and feedforward, the colorized phenomenon plot sequence displays not only the point on the time when adjustment is made but the point which alarm or a cover download phenomenon generates, for example. It may appear in order to display the details of the phenomenon which requires others and a window, when a user clicks these sequence top.
[0059]
The previous system was applied to the success reverse side in the wet oxidation process, and showed the capability to improve the precise nature and homogeneity. Although it is character top multivariate, it is efficiently returned to 1 set of scalar problems, and the problem faced in a wet oxidation process enables simple and reliable use of an ARRC control problem. In mounting of the Laon Tourane control, an ARRC system provides the tool which is integrated and has user compatibility, and provides modeling, adaptation, and control.
[0060]
In this wet oxidation process, the silicon oxidizing zone grew up to be loading of a wafer inside the diffusion furnace via the wet oxidation process. In this process, a silicon wafer is exposed to the steam by burning the mixture of hydrogen and oxygen which were controlled using flame or a torch by high temperature. A wafer is covered over a furnace and processed between the time specified at a given temperature. The Real Time Control machine is used in order to maintain the treatment temperature of the selected value with the thermo couple obtained in three different positions of the whole region of a wafer load. According to completion of this process, oxidation growth is measured in four positions covering the whole region of a wafer load. The process parameter which affects this growth includes processes run time and three temperature zone setting points. The purpose is to adjust these processes run parameter and to maintain the oxidation growth homogeneity of the request covering the wafer load whole region.
[0061]
One difficulty relevant to this problem is the complexity of a process model including lack of the symmetry resulting from the additional heat of the sequence zone generated on a torch and the heat loss in a load zone. In addition, the characteristic of this process changes according to the number of the wafers processed (originating in **** of a thermo couple, or degradation of an element). In order to compensate a modeling error and process **** carried out slowly, the Laon Tourane controller built by the above-mentioned method is used, A "control input" (oxidation time and temperature setting point) is adjusted using the growth measurement after each run as the Measurement Division input and the simple process model for adjusting the recipe parameter defined as the Measurement Division input and this VPT.
[0062]
formulate a wet oxidation process as a feedback control problem, and an ARRC system searches for the value of ** "control input" -- calculation -- and elaboration is carried out, and a process I/O value is driven and maintained on a desired level. As a problem of a term, the feedback control can give given

"input" and is considered to be the "process" or the "system" which generates an "output." This input or control is a signal which may be operated since the output change is affected. The output is an important (interest) signal which may be used for demarcating operation of a request of this process. desired operation -- carrying out -- quantification does by carrying out and measuring the output of ** and this process with a "target" or a "standard" value. For example, in a wet oxidation feedback control problem, the control input is oxidation time and oxidizing temperature. The output is the oxidation thickness in a different position covering the wafer whole region measured at the time of process completion.
On the other hand, a standard is a desired value of oxidation thickness.

[0063]
In the case of an oxidation process, the whole temperature locus can be considered as a control input. Of course, this is quite inconvenient from making a size in question and difficulty increase. On the other hand, the temperature maintained at the value prescribed a priori with the local Real Time Control machine is given, and the whole locus can be simply replaced by the single number which is a set point of temperature. The preciseness of the model obtained by this formulation is based on the capability of this local Real Time Control machine, and maintains a temperature set point in spite of a certain disturbance included in this process.
[0064]
Mathematically, the relation of an input and an output with a nonlinear form of memory saving is as a following formula.
[0065]
[Equation 1]

$$y_k = f[u_k]$$

Here, f [.] is usually a nonlinear function. In this composition, a control purpose value chooses u_k, and it may be demarcated so that y_k may approach and stay at r_k of the request prescribed a priori. Index **** in which k index-izes a run number here. This means that mathematical models and not no simple thing in particular can be offered only as approximation of a physical process. As a result, the nominal value (calculated by solving formula $f[u_k]-r_k=0$) of a control input only satisfies the control purpose value approximately. In addition, the disturbance or change in this process influences disadvantageously for the quality of this model, and draws the increase in error r_k-y_k.
[0066]
There are two additional approaches for correcting this situation. One is quoted with control-input improvement-ization and it calculates approximation correction which brings an error to zero at the end using an approximation model. Other approaches are quoted with model improvement and improve this model quality.
A new control input is calculated by using a new model.
The ARRC technique may be used so that any of these approaches or both may be mounted. However, selection of those approaches is dependent on a problem, because it is because it has the restriction which may generate the reaction which both do not expect potentially.
[0067]
The composition of ARRC in this example is based on the adaptive system discernment for performing model improvement and parameter estimation, the feedback control for performing control-input improvement, and the theory of numerical adaptation. In the generalized form, mounting of the ARRC technique contains the following four steps. That is, the step of model development, control-input initialization, model improvement, and renewal of a control input is included. Based on a user's selection, these steps are mounted in some different sequences like a process monitor, wild guess (one-shot)

modeling, non-adaptive control, and adaptive control, and control this process I/O, for example. Some cautions are explained below about each of these four fundamental steps.
[0068]
The model structure object mounted in the ARRC system of illustration about model development is a polynomial of a single input and a single output which has completely selectively a parameter which can be adjusted. Usually, this process model takes the following form.
[0069]
[Equation 2]

$$y_k = f[u k, \theta]$$

Here, (u, k) are input-output pairs and theta is a parameter which can be adjusted. For calculative convenience and reliability, about the linearity theta, i.e., a parameter, function f (., theta) is chosen so that it may be the affine (affine). This counts upon use of the least square calculation for model presumption from data which is simple and is reliable. While a more general model structure object is possible to be sure in the range of the above-mentioned ARRC system configuration, the simple model is usually suitable to the application meant. Here, the computing range is smallness which is sufficient for often enabling good approximation of input/output process moving state by an affine function.
[0070]
In a modeling step, it is presumed that the parameter of the model structure object by which the user choice was made fits 1 set of an input/output pairs. The presumption is performed using the least square approach with which a correction slight for numerical robustness was made. 1 set of fitting errors are calculated with the presumed model parameter (RMS and normalized RMS). These demarcate the quality of a foot in the way of making it possible easy selection of the most suitable model, and to avoid "superfluous parameterization." It should be taken notice of that superfluous parametarization is dependent on the input range which is possible only not only in the characteristic of the process of becoming the origin. Fitting error measurement provides the guideline over control and/or selection of an adaptation threshold (neutral zone) again, and when the output change is in the usual noise level, operation is not taken at all. Eventually, "regulation" conversion is calculated in this stage for the use in adaptation and a control step. This conversion is important for improving both the reliability of numerical computation, and a rate of convergence.
[0071]
About renewal of a control input, calculation of this control input uses the algorithm included in the classification of the inclination / Newton algorithm for the solution of a nonlinear equation. A Newton type algorithm has the convergence characteristic outstanding near the solution, and as long as "it is near", convergence does not become dramatically sensitive to the inaccurate nature of a model at the fine coefficient of the process that the fine coefficient (df/du) of a model is actual. however, some changes should do in this illustration application -- the "profit" parameter which offers the handle which adjusts the sensitivity of this technique for noise is included in this. The general form of renewal of a control input is as follows.
[0072]
[Equation 3]

$$u_{k+1} = u_k + \gamma_c \omega_{c,k} \varepsilon_{c,k} / (1 + \gamma_c \omega_{c,k}' \omega_{c,k})$$

Here, it is $e_{c,\ k}$=Dzn [r_k-y_k], $w_{c,\ \mathrm{and}\ k}$=df/du [u_k, theta_k], and Dzn [.] shows the neutral zone nonlinearity chosen based on the noise RMS level with which the threshold was calculated in the model-

development stage. The profit $gamma_c$ is calculated via the following formula from the error.
[0073]
[Equation 4]

$$\gamma_c = \gamma(e_{c,k}/\gamma_{dz})^2 \Big/ \left(1 + \left(e_{c,k}/y_{dz}\right)^2\right)$$

Here, y> 0 and $gamma_{dz}$ are the threshold parameters selected based on the noise RMS level. This nonlinear profit definition works effectively as a smooth neutral zone. The contribution of the important point is that the renewal of control is made on a high profit (equal to y), when an error is large. When this error is small, most contribution of the originates in noise, and the renewal of this is made from low interest profit which prevents the control-input adjustment with superfluous work effectively as a low pass filter.
[0074]
This renewal technique of a control input may be used in the two modes. Only one step of ITARESHON (iteration) is performed during an ordinary operation. On the other hand, in the case of the step of the beginning after a maintenance operation, it is permitted that the ITARESHON converges (control initialization).
The further step in the composition of an adaptive system is selection of the renewal technique of a parameter accompanied by the trade-off between pliability, noise induction parameter ****, a rate of convergence, and noise filtering character. The ARRC technique used for performing to renewal of this model parameter is the changed phasing memory least square which incorporated a neutral zone and parameter restrictions. The general form of the renewal technique of a parameter is as follows.
[0075]
[Equation 5]

$$\theta_{k+1} = \prod\left\{\theta_k + \gamma_p P_k^{-1} w_{p,k} e_{p,k} \Big/ \left(1 + \gamma_p w_{p,k}{}' P_k^{-1} w_{p,k}\right)\right\}$$

$$P_{k+1} = \alpha P_k + (1-\alpha)Q + \gamma_p \alpha w_{p,k} w_{p,k}{}'$$

Here, it is $e_{p,\,k}$=Dzn [y_k-$w_{p,\,k}$'$theta_k$], $w_{p,\,\text{and}\,k}$=df/du [u_k, $theta_k$]. Calculation of adaptive-gain $gamma_p$ is continuation to control gain. pi (..) shows the slanting projection operator based on parameter restriction setting out. Q is a small example of a positive-definite line, and the guarantee of that P_k is always a non-singular point and alpha** [0, 1] being a disregard factor (forgetting factor) is provided.
[0076]
A neutral zone works as an "information sorting machine style" by disregarding the data which hardly includes new information. A parameter restriction is committed to make the robustness of the algorithm which usually has a form of the boundary about the parameter estimation value which may be received, and counters parameter **** by which noise induction is carried out increase.
A neutral zone threshold, a parameter restriction, and conversion/regulation conversion may be chosen by the user between early modeling phases. It can be useful for parameter regulation conversion to reduce the state number of Hessian (Hessian)P especially, and, thereby, the convergence characteristic of this parameter estimation machine can be improved. Although this is careful and it should be applied, the susceptibility of this algorithm to noise may be made to increase. A parameter restriction may be derived by a physical principle (for example, df/du).
[0077]
It was used for the ARRC technique controlling a wet oxidation process as annotated previously. One of the main characteristics of this process is a loss which consists of asymmetry resulting from the

temperature gradient of a furnace at large.
This causes un-uniform oxidation thickness covering a wafer load.
How to correct usual [of this situation] is using a temperature setting point which is different in three heating zones.
This makes the compensation over the degrees of diverseness of an oxidation rate.
"Temperature Chill Tyng" and this procedure quoted often require readjustment of the excessive experiment referred to as that it is chosen as a good candidate, and a repetition, in order to investigate the advantage of the Laon Tourane control.
[0078]
It is used in the example of this wet oxidation, and, in the case of a process, control inputs are oxidation time and two termination zone temperature setting points.
On the other hand, the set point of a central zone is kept at 950-degree Centigrade.
Four examination wafers are used in each run, and the oxidation thickness is measured in a position which is different about each examination wafer. It was obtained using standard test composition about the input from which the group which consists of preliminary measured value of 23 pieces differs, and the preliminary model was built from these inputs. It was led to these measured value and this process input and the output were defined as that of the following like.
[0079]
y (1) is the average oxidation thickness of the omitted portion of two examination wafers.
y (2) and y (3) are the examination wafer average oxidation thickness of a flank, and a difference (A) between y (1).
u (l) is processes run time (minute). u (2) and u (3) are the temperature gradients (Celsius degree) to the set point of a central zone to a flank zone.
[0080]
The reasoning antecedent basis supporting these definitions is obtaining a square model with a diagonal predominance, and the Hessian adjusted appropriate. Although a diagonal predominance is not indispensable, this helps the simplification of the multivariate control problem by approximating on 1 set of scalar problems.
The ARRC technique ranked second and was examined by processing all of loading of 33 which becomes respectively from 200 wafers. The non-adaptive control machine was used to the first 22 loading, and, on the other hand, the adaptive control machine was used about the last 11. In all the cases, the target is the 1000-A oxidation thickness in all the processes run zones. In order to demonstrate the convergence characteristic of this controller, the time of the early process was chosen all the temperature setting points presupposing that it is the same so that 15% of thickness error might be induced. The result of the examination is shown in drawing 3 and drawing 4. After a very short transient change, it becomes to such an extent that the thickness error may compare with the usual noise level. Renewal of a control input is smooth appropriate. As for these results, it is compared as preferably as the usual operation data of the same process, and parameter adjustment of an SPC base is performed here. A remarkable advantage is provided in that the process result which the above-mentioned Laon Tourane control technique in which it progressed can predict [precise and] is obtained.
[0081]
The advantage of the Laon Tourane control technique with which other examples were incorporated again and which the above-mentioned followed is shown using any of feedback and feedforward control technique, or both. The comparatively simple feedback controller used within an ARRC system can improve remarkably process performances and the productivity of many fields of manufacturing environment. For example, in chemical mechanical polish (CMP) processing, polishing time is adjusted and the thickness of the remaining films may be controlled. This polishing time may be changed for every wafer or every batch depending on the stability of this process. When the adjustment for every wafer is required, the Measurement Division for closing this loop provided with measured value is needed on time in a proper place (inch-situ). However, supposing process **** is recognized, it may be used in order that a feedback model may predict and adjust to the polishing time required of each wafer of a batch. Polishing time may be changed with a wafer from a wafer based on model presumption using the feedback control algorithm mounted by the ARRC system, and may be verified by Measurement

Division after completion of this batch. A feedback controller may be used within an ARRC system again, in order to compensate automatically the change in the slurry (slurry) of a polishing pad, and degradation.
[0082]
Profits will be obtained since the Laon Tourane control technique with which the diffusion process was explained is used as other examples. A diffusion process requires that it should adjust multivariate simultaneously occasionally. For example, the low-pressure power chemicals steamy deposition (LPCVD) batch process should usually require temperature and adjustment. The feedback controller used within an ARRC system adjusts the temperature of an end zone, and minimizes the difference of the thickness between the center section of the furnace, and the end zone of a furnace. A feedback controller may adjust assembly time again, in order to put this process on a desired thickness target. A simple model is effective in both a linear LPCVD deposition process and a nonlinear oxidation process.
[0083]
In the dirty treatment process for controlling a critical size (CD) linewidth, the feedback adjustment made by an ARRC system is useful again. Terminal-point detection is used for many dirty treatment processes in a proper place. If a terminal point is established, the recipe will carry out dirty processing of this film between the excess dirty time continued and defined in advance. The influence of this terminal-point time and excess dirty processing time is measured in film thickness and CD. The automatic feedback control in an ARRC system may be applied in order to adjust the dirty treatment process or this excess dirty time doubled with the tide in the terminal-point drive process. The relation between the thickness and CD to dirty time, a gas mass flow, and the dirty processing process parameter like electric power which were removed may be modeled and controlled using an ARRC system.
[0084]
a certain process can generate a reproducible result using feedback control Measurement Division -- although I will come out -- the process result -- it may be dependent on the initial state of a wafer. The automatic regulation based on this initial state may be attained by feedforward modeling. Supposing a feedforward control algorithm is used, the process currently controlled will be preferably in any of whether originally it is stable or to provide stability using effective feedback mechanism (for example, ARRC system feedback control algorithm).
[0085]
One example with a useful feed-forward control mechanism is in adjustment of the dirty processing time for removing the dielectric operation in the layer of the intervening interconnection. Since the signal strength for which a little films removed are usually needed is not provided, this type of dirty treatment process must have been controlled depending on terminal-point detection of a proper place. Instead, this process is **** which removes all the films for the first trial preferably. The initial thickness of this film usually needs to be chosen to this process. The feedforward process to which this information will set the target over the feedback control for this initial film being measured and removing the dielectric operation in a layer may be provided by an ARRC system.
[0086]
as other examples which become useful, the feed-forward control within an ARRC system comes out in a chemical-polishing (CMP) process. In this process, in the early charge of facing, it is usually various, and becomes here where the same diversity is brought about after polish. or [that the feedforward controller in an ARRC system is used so that a feedback controller target (quantity of the material which should be ground) may be adjusted after each run, and measuring a wafer in advance of polish removes this diversity after polish] -- or it can minimize.
[0087]
the feed-forward control within an ARRC system is useful -- being the further -- others -- as an example, the pouring barrier before sacrifice oxidation layer growth is strange -- him -- it is controlled and manufacture is improved for a transistor and the same semiconductor device. the pouring barrier in this point and a manufacture process is strange -- him -- it should have influence harmful to the profit of a transistor -- it comes out. In the usual example of manufacture, oxidation and a nitrated case grow and it deposits on a wafer. A slot is formed in a nitrated case using lithography and a dirty treatment process. In shaping of this slot, excess dirty processing of the nitriding is carried out, and a certain

amount of removal of an initial oxidizing zone is brought about. A sacrifice oxidation layer grows up to be a slot covering this early oxide, and creates the barrier for pouring. Excess dirty processing of a nitrated case depends and the size of this pouring barrier changes for every run. Using the feedforward control algorithm in an ARRC system, change which makes a cause an oxidation and nitriding dirty processing step, and carries out ingress is minimized by measurement of the beginning of the initial oxidizing zone after nitriding dirty processing, and ranks second, Using a feedforward controller, the target of the feedback controller about a sacrifice oxidation program is ******(ed), and the more consistent pouring barrier can be maintained.

[0088]

In the lithography field, feed-forward control which is mounted by an ARRC system is used in order to calculate an alignment parameter the whole wafer, and thereby, it can provide a possibility over the processes run of the lower stream using feedback control of having been improved. These are usually 6 thru/or 8 parameters which may be predicted with the first model. Although a tilt may be adjusted, a usually quite more complicated model is required.

[0089]

although desirable working example was indicated, many which remain in the thought and the range of this invention are strange -- him -- it is possible. this -- strange -- him -- it becomes clear for the person skilled in the art after scrutinizing these details and Drawings. Therefore, this invention is not restricted besides being restricted to the pneuma and the range of a description of a claim of attached.

[Brief Description of the Drawings]

[Drawing 1 A] It is a block diagram of a hardware platform in which the Laon Tourane controller of this invention is performed.

[Drawing 1 B] It is a block diagram of the further hardware platform in which the Laon Tourane controller of this invention is performed.

[Drawing 2]It is the figure showing one gestalt of the software component used for the Laon Tourane controller of this invention performing.

[Drawing 3]It is the graph which shows the executed result when the Laon Tourane controller of this invention is applied to the wet oxidation deposition process of illustration.

[Drawing 4]They are other graphs which show the executed result when the Laon Tourane controller of this invention is applied to the wet oxidation deposition process of illustration.

[Drawing 5]In order to use it in the Laon Tourane controller, it is the block diagram showing renewal of the variate parameter table (VPT) relevant to various process tools.

[Drawing 6]It is the block diagram showing the Laon Tourane control process flow by desirable working example of a description.

[Drawing 7]It is the figure showing the contents of the suitable variate parameter table (VPT).

[Drawing 8]It is the flow chart showing the Laon Tourane controlling process of drawing 6 from the alternative viewpoint.

[Brief Description of Notations]

25 Manufacture surveillance workstation (FSW)

30 Equipment surveillance workstation (ESW)

35 Processes run tool 36 The work piece 37. VPT 40 measurement device 70 Measurement Division broker . 75 ARRC controller 85 Measurement Division database . 90 GEM host interface 92. SMC result 95 CIM composition (CORBA) interface . 100 ESM measurement device interface . 105 Manual Measurement Division input interface 110. The ARRC technique 115 tool server 205. Measurement Division map 207 Control point definition 210 feedforward control algorithm 215 process goal intervention 220 feedback-control algorithm 221 model / controller plug-in 225 VPT variate adjustment 230 download adjustment

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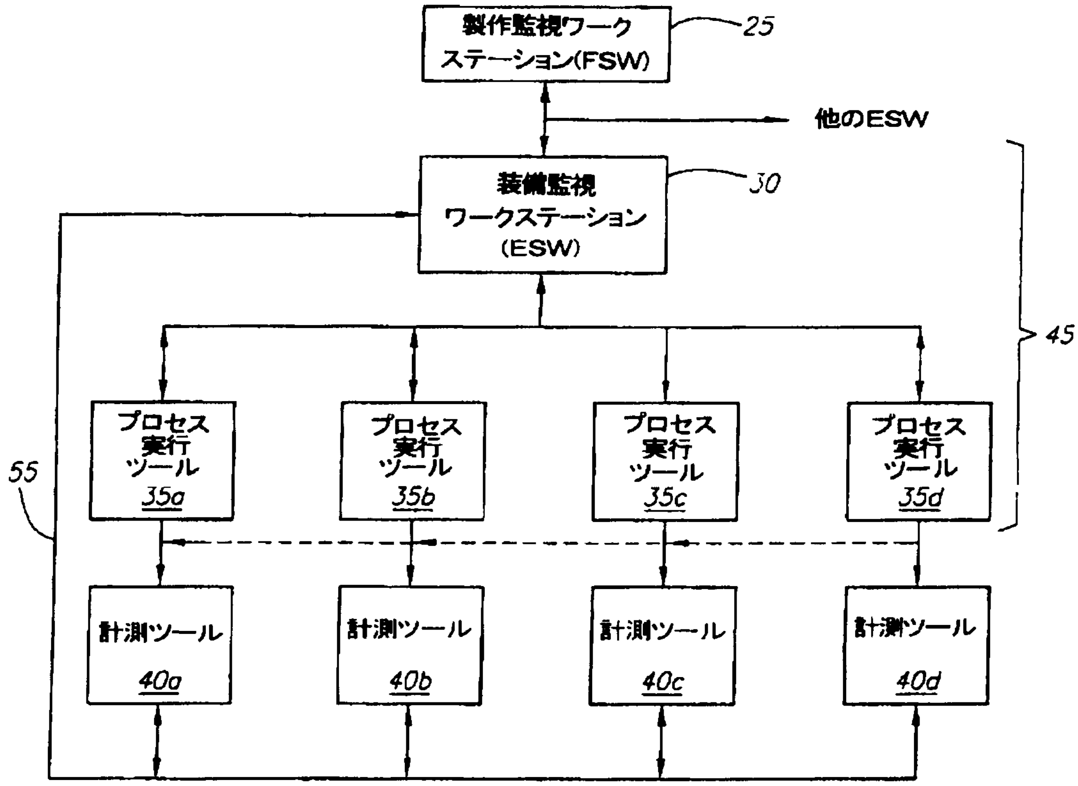
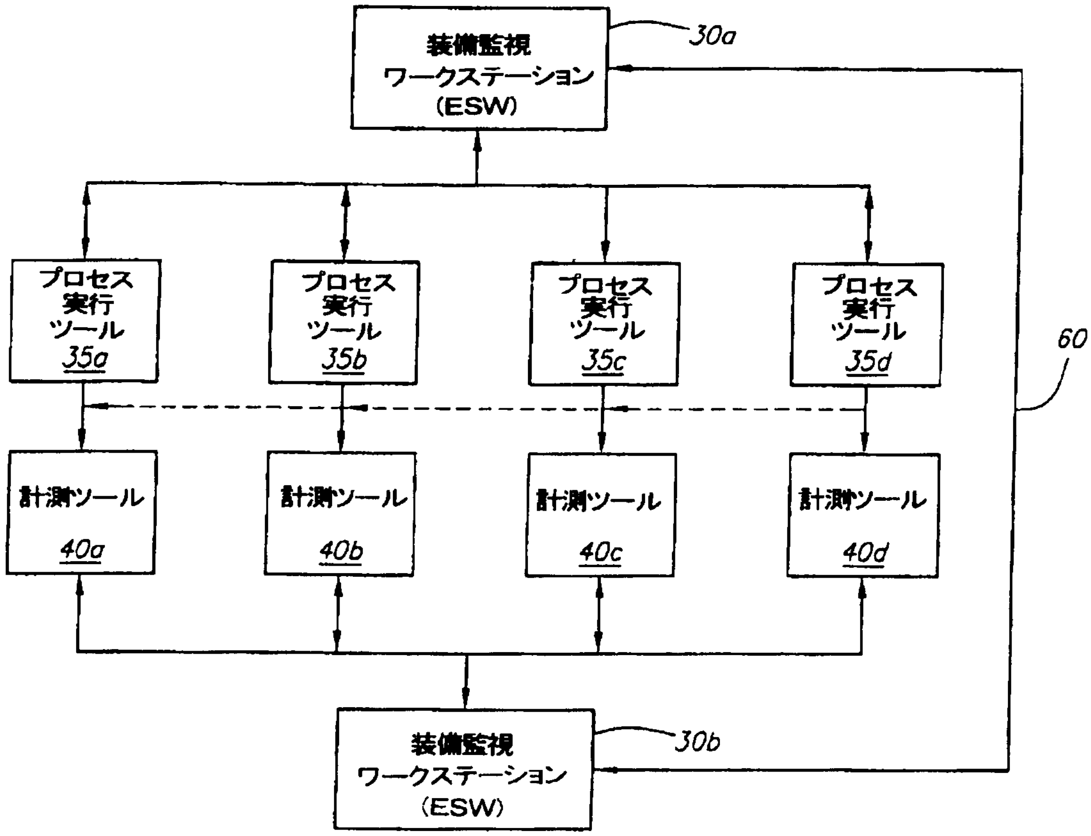
[Translation done.]

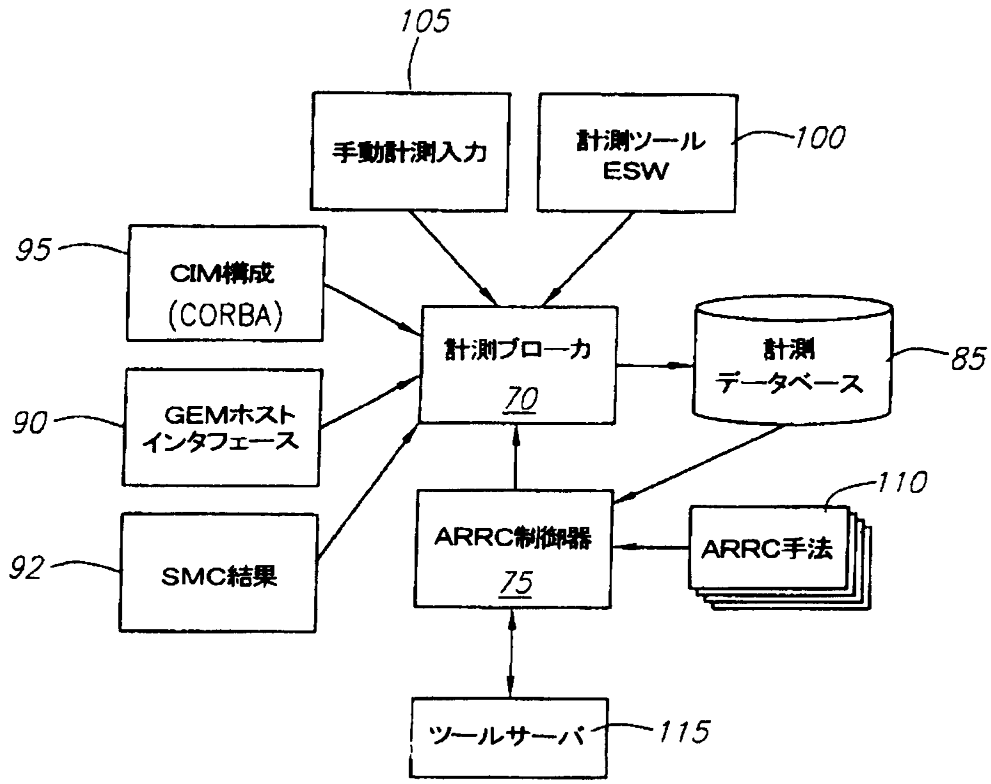
【図１Ａ】


製作監視ワークステーション(FSW)
25
他のESW
装備監視ワークステーション(ESW)
30
45
プロセス実行ツール 35a
プロセス実行ツール 35b
プロセス実行ツール 35c
プロセス実行ツール 35d
55
計測ツール 40a
計測ツール 40b
計測ツール 40c
計測ツール 40d

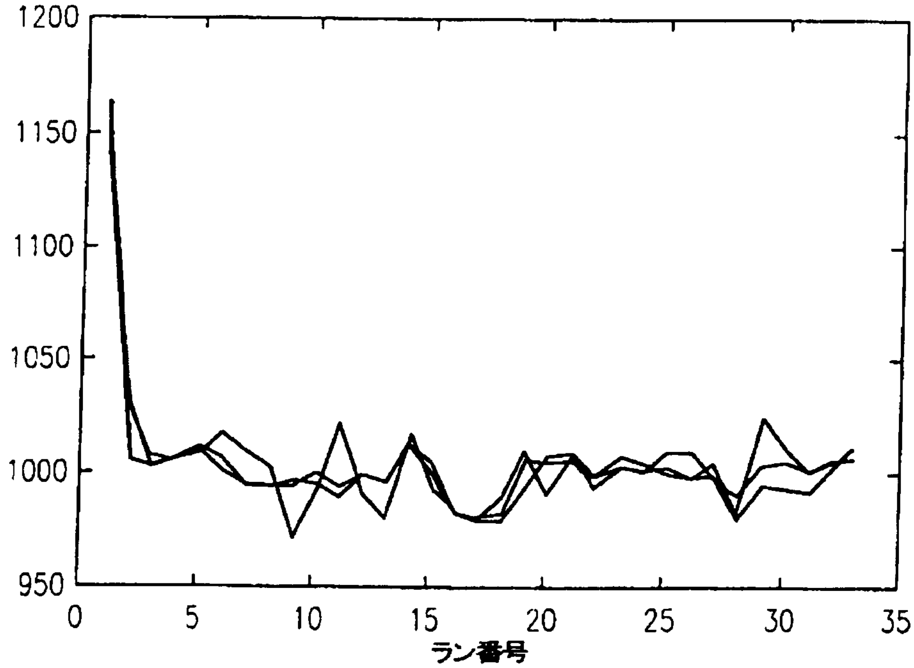
【図１Ｂ】


装備監視
ワークステーション
(ESW)
30a
プロセス
実行
ツール
35a
35b
35c
35d
計測ツール
40a
40b
40c
40d
60
30b

【図２】

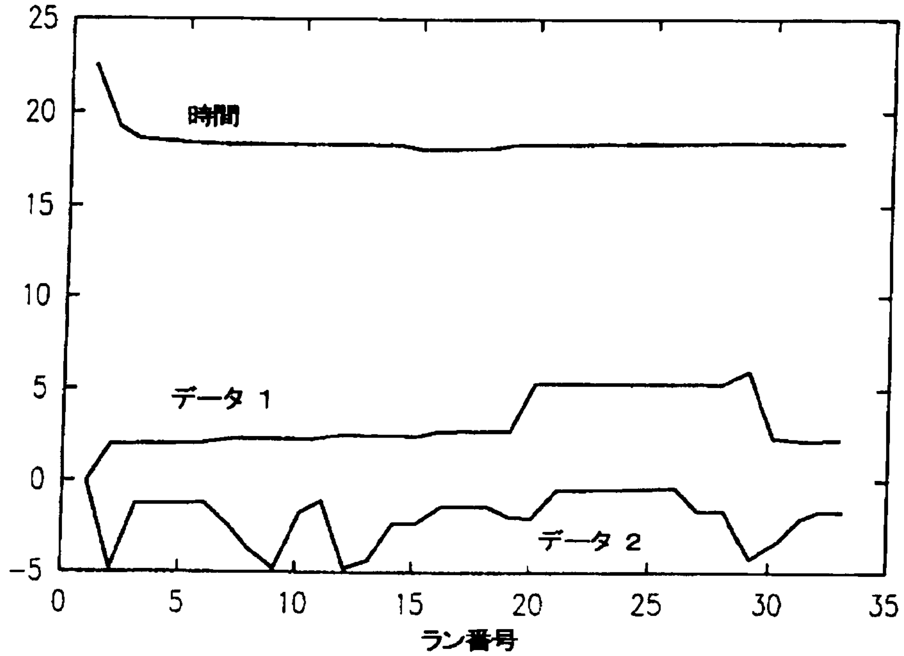

105
手動計測入力
計測ツール
ESW
100
95
CIM構成
(CORBA)
計測ブローカ
70
計測
データベース
85
90
GEMホスト
インタフェース
110
92
SMC結果
ARRC制御器
75
ARRC手法
ツールサーバ
115

【図３】

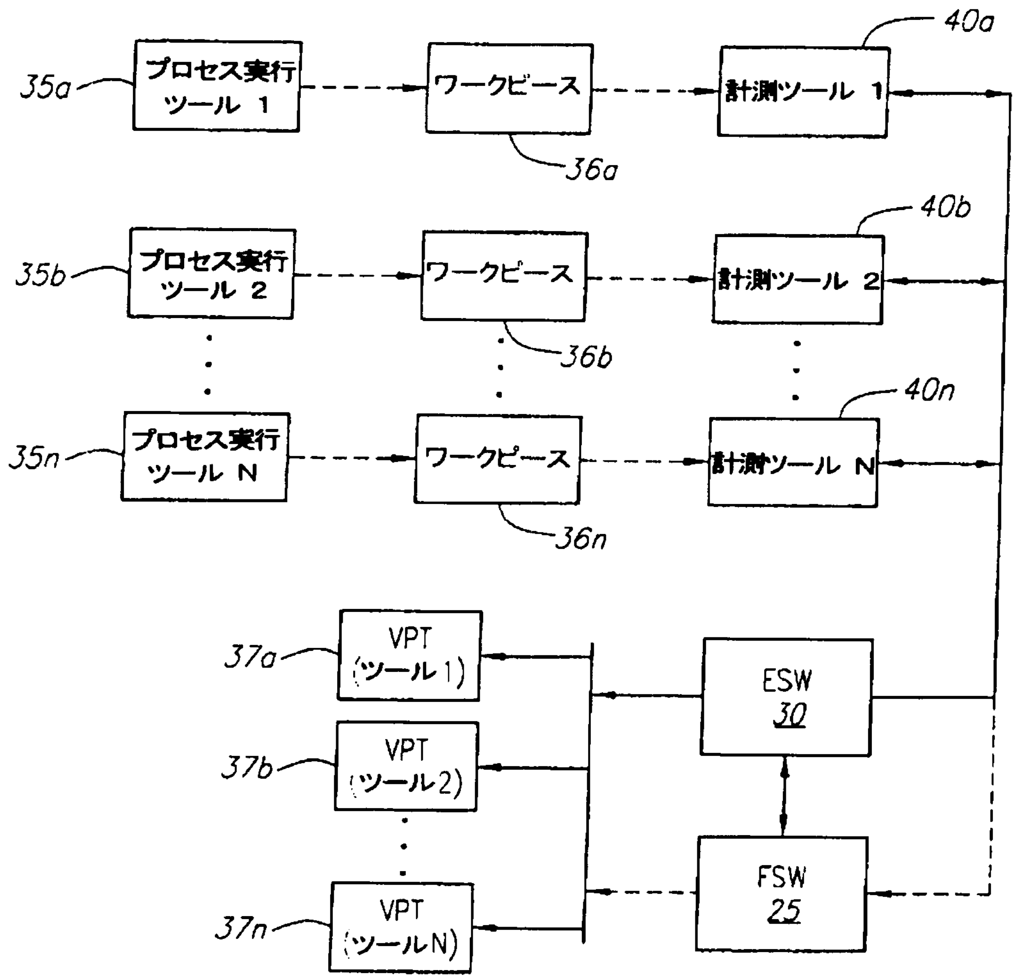


3つのゾーンの酸化厚
（サンプル１～２２：非適応制御、サンプル２３～３３：適応制御）

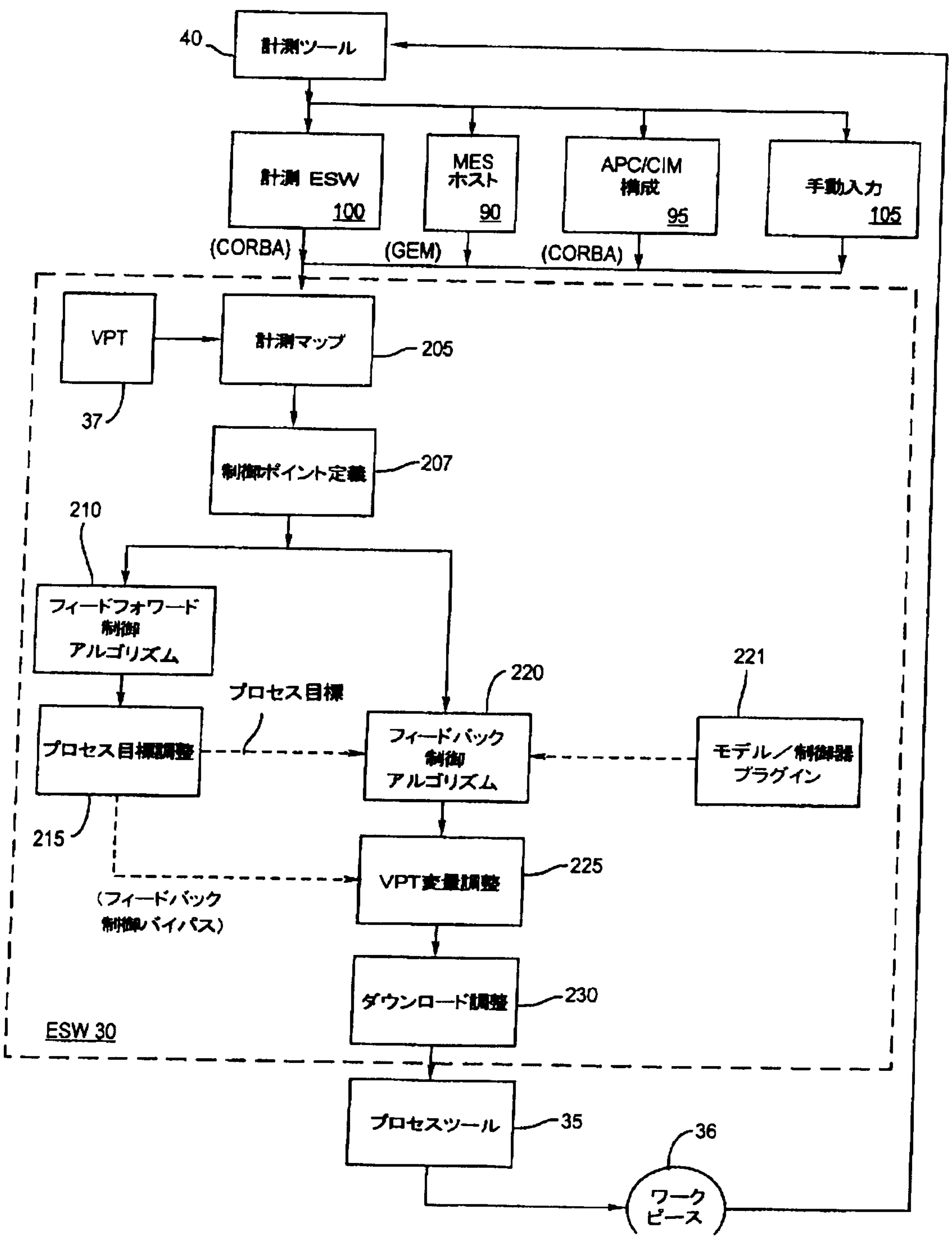
【図４】



【図５】


35a
プロセス実行ツール 1
ワークピース
36a
計測ツール 1
40a
35b
プロセス実行ツール 2
ワークピース
36b
計測ツール 2
40b
35n
プロセス実行ツール N
ワークピース
36n
計測ツール N
40n
37a
VPT (ツール1)
37b
VPT (ツール2)
37n
VPT (ツールN)
ESW 30
FSW 25

【図６】



計測ツール
40
計測 ESW
100
MES
ホスト
90
APC/CIM
構成
95
手動入力
105
(CORBA)
(GEM)
(CORBA)
VPT
37
計測マップ
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207
210
フィードフォワード
制御
アルゴリズム
プロセス目標
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フィードバック
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221
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制御バイパス）
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プロセスツール
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36
ワーク
ピース

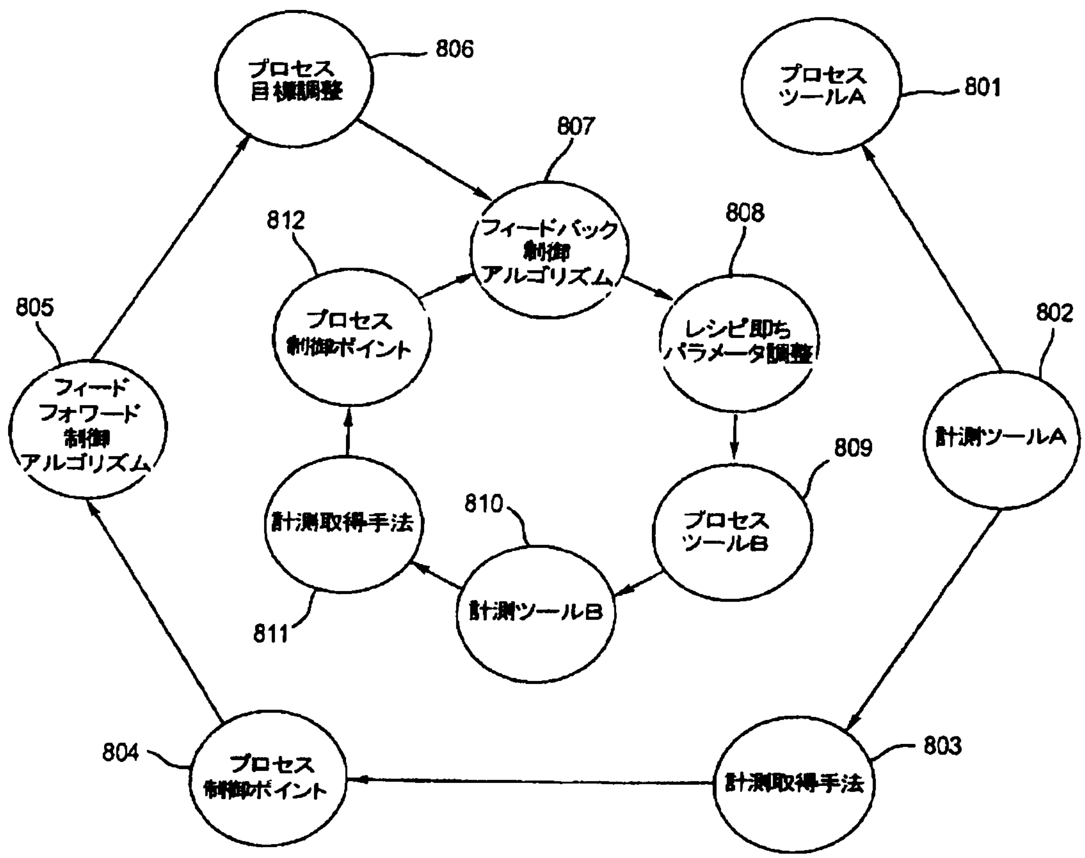
【図７】

VPT フォーマット

変数	最小	最大	表記	最大Δ	ディフォルト	アクセス

●
●
●

【図８】



【国際調査報告】

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/17071

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G05B19/418

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 495 417 A (MIURA KAZUYKI ET AL) 27 February 1996 (1996-02-27) abstract column 5, line 35 - line 50 column 13, line 35 -column 20, line 8 column 23, line 40 -column 25, line 6 column 28, line 12 -column 48, line 12 figures 1,2,9-11,38,91-96	1-32, 38-56
X	US 5 492 440 A (SPAAN HENRICUS A M ET AL) 20 February 1996 (1996-02-20) the whole document	1,3, 6-11,15

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 October 2000	27/10/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Helot, H

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INTERNATIONAL SEARCH REPORT

I. .mation on patent family members

Interna) Application No
PCT/US 00/17071

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
US 5495417	A	27-02-1996	JP	5266029	A	15-10-1993
			JP	6110894	A	22-04-1994
			JP	5216896	A	27-08-1993
			JP	6252236	A	09-09-1994
			JP	6260380	A	16-09-1994
			JP	6176994	A	24-06-1994
			US	5694325	A	02-12-1997
			JP	5151231	A	18-06-1993
US 5492440	A	20-02-1996	DE	69419819	D	09-09-1999
			DE	69419819	T	17-02-2000
			EP	0625739	A	23-11-1994
			JP	7098607	A	11-04-1995

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(81)指定国　EP(AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OA(BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG), AP(GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), EA(AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW

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【要約の続き】
ワードモデル表記（単一又は多変量）が、該システムに対する試験的又は予想される動態に基づいてインタラクティブに選択されても良く、そして又、ユーザをしてラントゥーラン制御に対してユーザ独自のモデルを使用ならしめても良い。